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## JAMA Clinical Evidence Synopsis

# Peripherally Inserted Central Catheters vs Peripheral Cannulas for Delivering Parenteral Nutrition in Neonates

Sean B. Ainsworth, MD; William McGuire, MD

**CLINICAL QUESTION** Is parenteral nutrition via peripherally inserted central catheters (PICCs) associated with better delivery of nutrition and growth and fewer adverse events compared with short peripheral cannulas in neonates?

**BOTTOM LINE** Compared with short peripheral cannulas, parenteral nutrition via PICCs is associated with better nutrient delivery and lower rates of subsequent catheters or cannulas placed and is not associated with increased rates of invasive infection.

Peripherally inserted central catheters (PICCs), sometimes called percutaneous central venous catheters, provide intravenous fluids to preterm or sick neonates who cannot tolerate enteral feeds or who require gradual introduction of such feeds. This JAMA Clinical Evidence Synopsis summarizes a Cochrane Review<sup>1</sup> that examined whether PICCs are associated with higher nutrient input and better growth compared with short peripheral cannulas but are not associated with increased morbidity (including infection) and mortality in neonates.

PICCs are inserted via a superficial vein and advanced so that the tip lies in a larger central vein. Because PICCs last longer than short peripheral cannulas (intravenous lines), they may be associated with more consistent fluid and nutrient delivery, lower rates of subsequent catheter or cannula placements, and a lower risk of extravasation with hyperosmolar parenteral nutrition solutions.<sup>2</sup> A disadvantage is the risk of invasive infection, the most common serious

complication associated with PICCs that can affect up to one-third of patients<sup>3</sup> depending on the diagnostic criteria and the population studied.

## Summary of Findings

Neonates with PICCs received higher proportions of prescribed volumes of parenteral nutrition compared with short peripheral cannulas (96.8% vs 89.7%, respectively; mean difference, 7.1% [95% CI, 3.2% to 11.0%]). No trials reported growth parameters. There were no associations of catheter type with in-hospital mortality (10/196 [5.1%] vs 8/203 [3.9%]; risk ratio [RR], 1.31 [95% CI, 0.36 to 4.81]), or extravasation injury (1/102 [1.0%] vs 5/106 [4.7%]; RR, 0.36 [95% CI, 0.07 to 1.75]) or invasive infection (67/271 [24.7%] vs 72/278 [25.9%]; RR, 0.95 [95% CI, 0.72 to 1.25]) (Figure). PICC use was associated with fewer subsequent catheters or cannulas inserted during the trial period (mean difference, -3.1 [95% CI, -4.1 to -2.06]).

## Discussion

Because there were fewer interruptions to infusions when vascular access was lost (eg, if the cannula or catheter was dislodged or required removal due to inflammation around the entry site), PICC use was associated with more consistent delivery of parenteral nutrition, and neonates received a higher proportion of their prescribed parenteral nutrition compared with those with short peripheral cannulas. There were no differences between the 2 catheter types in associations with mortality, extravasation injury, or invasive infection.

## Limitations

Most neonates in these trials were receiving parenteral nutrition to supplement their enteral milk intake following preterm delivery. The typical duration of PICC placement (dwell time) for parenteral nutrition delivery was 7 to 10 days. It is uncertain whether or to what degree any nutrient deficit during this period is associated with longer-term growth or developmental outcomes. There were too few studies to detect more serious complications such as pericardial effusion (estimated to occur at a rate of 1.8 per 1000 PICCs).<sup>4</sup> Insufficient data were available for a subgroup analysis by gestational age.

### Evidence Profile

No. of studies: 6

No. of randomized clinical trials: 6

Study years: Conducted, 1998-2013 (reported for 4 of 6 trials); published, 1995-2014

No. of patients: 549

Race/ethnicity: Not reported

Age: 26-31 weeks average gestation at birth

Settings: Neonatal intensive care units

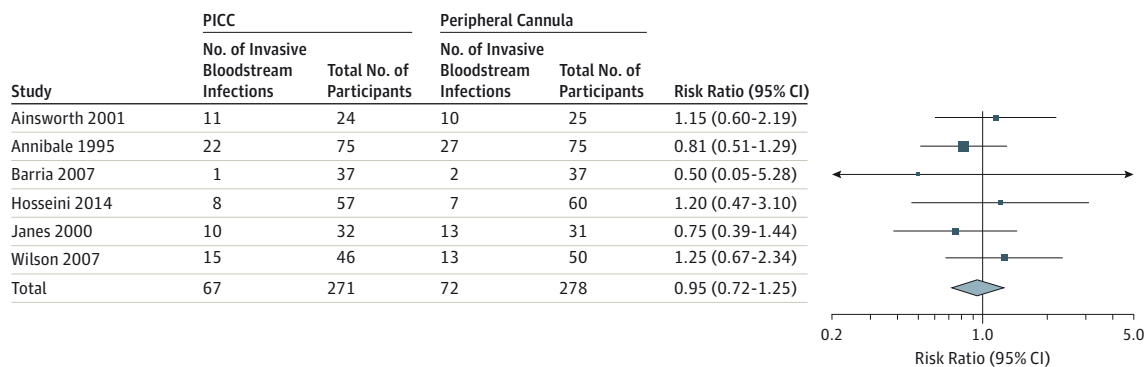
Countries: Chile, Iran, United Kingdom, and United States

Comparison: Peripherally inserted central catheters vs peripheral venous cannulas to administer parenteral nutrition in neonates

Primary Outcome: Nutrient input (amounts of parenteral nutrition given as a proportion of the prescribed volume), growth, and development

Secondary Outcomes: All-cause neonatal and predischARGE mortality; confirmed invasive bacterial or fungal infection, or both; extravasation injury; number of cannulas or catheters used to administer parenteral nutrition during the trial period

**Figure. Invasive Bloodstream Infection Events in Neonates Receiving Parenteral Nutrition via Peripherally Inserted Central Catheter (PICC) or Peripheral Cannulas**



The size of the data marker indicates the weight of the study.

Therefore, it is unclear whether the results are applicable to the most vulnerable group of extremely preterm infants.

#### Comparison of Findings With Current Guidelines

In 2011, the US Centers for Disease Control and Prevention Healthcare Infection Control Practices Advisory Committee guidelines<sup>2</sup> recommended PICC instead of a short peripheral cannula "when the duration of intravenous therapy will likely exceed six days." The findings of this meta-analysis support this.

#### Areas in Need of Future Study

Adequately powered randomized clinical trials are needed to determine whether PICCs are associated with better growth and neurodevelopmental outcomes compared with peripheral cannulas, particularly in extremely preterm infants for whom early nutrition may be especially important. Additional studies are also needed to determine whether to remove the catheter when infection is suspected,<sup>5</sup> or whether antimicrobial impregnated PICC use is associated with a reduced risk of infection.<sup>6</sup>

#### ARTICLE INFORMATION

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**Submissions:** We encourage authors to submit papers for consideration as a JAMA Clinical Evidence Synopsis. Please contact Dr McDermott at [mdm608@northwestern.edu](mailto:mdm608@northwestern.edu).

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